choice suggests that they are made better off. The two a-la-carte options similarly will increase choice. In addition, none of the packages which combine content from both services would have been available absent the merger. Offering these additional price/programming will also lead to increased subscriptions to the merged firm.

Appendix A

Dynamic Demand Functions and Implications for Merger Analysis:

Penetration Pricing and Dynamic Spillover Effects

The purpose of this Appendix is three-fold. First, this Appendix will analyze the pricing decision of a firm facing a *dynamic demand function.* Such demand functions arise when current sales of the product have a *spillover effect* on future sales, that is, future demand for the product will be higher if there are higher current sales. The pricing analysis will show that a firm operating in this type of environment has an incentive to engage in *penetration pricing*, the strategy of charging a relatively low current price as a means of promoting future sales. This is because a low current price represents an investment in future demand.[1]

Second, this Appendix will draw implications of penetration pricing for market definition. In particular, dynamic demand and penetration pricing imply that a naive application of the *ssnip* test based on the standard (static) Lerner condition likely would be misleading.

Third, this Appendix will examine the implications of dynamic demand and penetration pricing on competitive effects analysis in merger cases. A firm's low penetration pricing generates a positive externality on other firms' future profits because the dynamic spillover effect increases the future sales of *all* the firms, not just own future sales. This gives rise to a pro-competitive justification for mergers, as the merged entity will internalize this externality and thus will have a greater incentive to engage in low penetration pricing.

The rest of this Appendix is organized as follows. Section 1 provides a brief introduction to dynamic demand functions and foreshadows how they affect a firm's pricing behavior. Section 2 describes formally a firm's pricing decision in the presence of dynamic demand functions, showing that such a firm has an incentive to engage in penetration pricing. Section 3 derives implications of penetration pricing for market definition and competitive effects analysis in the context of mergers.

This Appendix focuses attention to a firm's pricing decision. However, it should also be emphasized that the same ideas apply to other demand-enhancing investments, such as investments in product quality and advertising. Furthermore, they also apply to investments in technologies that reduce variable costs.

1. A Brief Introduction To Dynamic Demand Functions

New products often have the characteristic that the demand for the product will be higher

[1] The dynamic demand spillover effect is similar to the "goodwill" effect described in Jean Tirole, THE THEORY OF INDUSTRIAL ORGANIZATION (MIT Press 1990) at 71.

in the future, if there are higher current sales. In economics jargon, the *demand function* is *dynamic* because current sales have a *spillover effect* on future sales. This interdependence between current and future sales has numerous possible causes, depending on the characteristics of the product and the market.

First, dynamic demand can be attributed to a process of *information diffusion*, which can take various forms. For example, it could involve word-of-mouth diffusion from early adopters to late adopters that raises awareness for the product. In effect, early adopters could act as "marketing agents" on behalf of the firms providing the product.[2] The dynamic demand also could describe a more general informational phenomenon of "viral marketing." For example, people may become more comfortable with the product over time as it has "proven itself" in the marketplace.

Second, dynamic demand can be attributed to *network effects or bandwagon effects*. Network effects would occur if the value of the product to consumers increases as more other consumers acquire the product.[3] Alternatively, over time additional sales of the product may lead it to become more fashionable, creating a bandwagon effect that increases future sales growth. Similarly, the incentives of retailers can also give rise to dynamic demand functions, if retailers are more willing to invest in promoting a product if and when the product has proven to be popular.

Third, dynamic demand can be attributed to *consumer inertia or other switching costs*. For example, suppose that consumers are more willing to purchase a non-durable product in the future if they begin purchasing in the present.[4] In that case, future demand will be increased if current sales rise. This consumer inertia could be psychological. It could involve habituation, as in the case of cigarettes.[5] Alternatively, the inertia could arise if consumers invest in learning how to use a product, as in the case consumer software. In that latter type of situation, when the product wears out or is replaced by upgrades, the consumer is more likely to purchase the product already being used. Again, this would

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[2] The foundations of information diffusion theory are presented in the seminal work of Everett M. Rogers, DIFFUSION OF INNOVATIONS (1983). Frank M. Bass, *A New Product Growth Model for Consumer Durables*, 15 MGMT. SCI. 1825 (1967) suggested a mathematical formulation of the theory, which gave rise to a large literature in marketing. A survey of this literature can be found in Vijay Mahajan, Eitan Muller & Yoram Wind (eds.), NEW-PRODUCT DIFFUSION MODELS (2000).

[3] *See, e.g.*, Joseph Farrell & Garth Saloner, *Standardization, Compatibility, and Innovation*, 16 RAND J. ECON. 70 (1985), and Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985).

[4] A survey of work on markets in which consumers face switching costs can be found in Paul Klemperer, *Competition When Consumers Have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade*, 62 REV. OF ECON. STUDIES 515 (1995).

[5] *See* Gary S. Becker & Kevin M. Murphy, *A Theory of Rational Addiction*, 96 J. OF POLIT. ECON. 675 (1988).

lead to higher current sales driving higher future sales too.[6]

In such an environment, the behavior of a myopic firm that would maximize short-term profit does not coincide with that of a rational, forward-looking firm that maximizes long-term profit.[7] In particular, a forward-looking firm facing a dynamic demand function has an incentive to set a lower current price, relative to the one it would charge if it maximized short-term profit. In this way, the firm can boost the future demand for its product, with the resulting increase in long-term profit more than offsetting the initial decrease in short-term profit. This strategy of setting a lower current price is referred to as *penetration pricing*. The low current price is an investment in future demand. Similarly, the firm has an incentive to spend more, than it otherwise would, on both demand-enhancing investments (product quality improvements and advertising) and cost-reducing investments. This is because the resulting increases in current sales due to these investments will have a dynamic spillover effect, increasing future sales as well.

The rest of the Appendix formalizes the idea that a firm facing a dynamic demand function has an incentive to engage in penetration pricing and other investments, and then derives several implications of these incentive effects for merger analysis.

2. Pricing In The Presence Of A Dynamic Demand Function

To illustrate, consider a firm that sells its product in a market that lasts for two periods. In period 1 (present) the demand for the firm's product is given by:

$$Q_1 = d_1(P_1) \qquad \text{(A1)}$$

where Q_1 and P_1 denote the quantity and price of the firm's product in period 1, respectively. The function $d_1(P_1)$ is assumed to be decreasing, reflecting the standard assumption that the volume of sales decreases as the price increases.[8]

In period 2 (future) the demand for the firm's product is given by:

$$Q_2 = d_2(P_2, Q_1) \qquad \text{(A2)}$$

where Q_2 and P_2 denote the quantity and price of the product in period 2, respectively. The

[6] For a model of dynamic demand due to consumer learning, *see* J. Miguel Villas-Boas, *Consumer Learning, Brand Loyalty, and Competition*, 23 MKTG. SCI. 134 (2004).

[7] There is a large literature that discusses the pricing decision of firms facing dynamic demand functions. The pricing problem of a single seller facing dynamic demand is worked out, among others, by Shlomo Kalish, *Monopolist Pricing with Dynamic Demand and Production Cost*, 2 MKTG. SCI. 135 (1983). An extension to an oligopolistic setting is provided by Engelbert Dockner & Steffen Jorgensen, *Optimal Pricing Strategies for New Products in Dynamic Oligopolies*, 7 MKTG. SCI. 315 (1988).

[8] The demand for the firm's product (implicitly) depends also on the prices of other products. For simplicity, we hold the prices of these other products constant.

function $d_2(P_2, Q_1)$ satisfies two assumptions: i) it is decreasing in the second-period price (P_2), and ii) it is increasing in the first-period quantity (Q_1). The former assumption says that the volume of sales in period 2 (Q_2) decreases as the price in period 2 (P_2) increases. The latter says that current sales have a spillover effect on future sales, such that an increase in the volume of current sales (Q_1) leads to a higher volume of future sales (Q_2). This could reflect, for example, the fact that in period 1 information diffuses from early adopters to late adopters and creates higher future demand for the product.

The firm will set prices in periods 1 and 2 so as to maximize the discounted sum of its profits from both periods (*i.e.*, its long-term profit). In other words, the firm solves:

$$\max_{P_1,P_2} \Pi_1 + \delta \Pi_2 = (P_1 - C_1) d_1(P_1) + \delta (P_2 - C_2) d_2(P_2, Q_1) \tag{A3}$$

where C_1 and C_2 denote the firm's (constant) marginal cost in periods 1 and 2, respectively, and $\delta > 0$ denotes the "discount factor" between periods 1 and 2.[9]

Letting $s = \partial d_2(P_2, Q_1) / \partial Q_1$ denote the dynamic spillover effect between current and future sales, the first-order conditions for profit maximization yield:

$$\frac{(P_1 - C_1) + \delta s (P_2 - C_2)}{P_1} = \frac{1}{E_1} \tag{A4}$$

$$\frac{P_2 - C_2}{P_2} = \frac{1}{E_2} \tag{A5}$$

where E_1 and E_2 denote the price elasticities of the demand functions $d_1(P_1)$ and $d_2(P_2, Q_1)$, respectively.

Equation (A5) is the standard *static* Lerner condition that determines the optimal price in period 2. It says that the profit margin in period 2 (expressed as a percentage of the second-period price) is equal to the inverse elasticity of demand in period 2.

Equation (A4) is a *dynamic* Lerner condition that determines the optimal price in period 1. It is similar to the standard static condition, except that the relevant profit margin is not just the first-period margin (*i.e.*, $P_1 - C_1$) but also includes the discounted future margin obtained in period 2 from an additional sale in period 1 (*i.e.*, $\delta s (P_2 - C_2)$).

[9] One can assume that the discount factor is less than 1, i.e., $\delta = 1/(1+r)$, where r is the rate of interest. Alternatively, one can assume $\delta > 1$ if period 2 in fact corresponds to many (identical) periods.

Moreover, inspecting equation (A4), it follows that the presence of dynamic spillover effects tends to reduce the price in period 1, relative to the case of no dynamic spillover effects (*i.e.*, the case with $s = 0$). To see this, it is useful to re-write equation (A4) as shown below:

$$\frac{P_1 - [C_1 - \delta s(P_2 - C_2)]}{P_1} = \frac{1}{E_1} \qquad \text{(A6)}$$

This says that the dynamic spillover effect makes the firm behave as if its first-period marginal cost was lower by the amount $\delta s(P_2 - C_2)$, which is the discounted margin that the firm will obtain in period 2 from an additional sale in period 1. As a result, in the same way that a reduction in marginal cost induces a firm to lower its price, the dynamic spillover effect tends to reduce the price in period 1. Thus, the benefit of the spillover effect is also shared by consumers in the form of a lower price. All else equal, the greater the extent of the dynamic spillover effect, s, the more pronounced is the incentive to lower the price.[10]

The intuition behind the result is straightforward. When current sales lead to higher future sales, *i.e.*, $s > 0$, the firm faces the following trade-off between current and future profits. By setting a lower first-period price, relative to the price that maximizes the (short-term) first-period profit, the firm foregoes some profits in the first period. At the same time, however, the lower price allows the firm to expand sales in the first period, which in turn increases demand and hence profitability in the second period. In a longer time frame, this effect will continue to occur as long as demand exhibits dynamic spillover effects.

In this respect, it is important to note that in a model with N>2 periods of dynamic demand, the incentive to engage in penetration pricing continues until the very last period. Only in the very last period will there be no future benefits of holding price below the short-term profit-maximizing level.

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[10] For example, if $C_1 = C_2 = 1$ and $E_1 = E_2 = 2$, then Equations (A4) and (A5) imply the following optimal prices: $P_2 = 2$ and $P_1 = 2(1 - \delta s)$. Thus, the stronger the dynamic spillover effect (i.e., the higher the value of s), the lower the price in period 1. To illustrate this point, suppose that the discount rate is $\delta = 1$ and the dynamic spillover effect is initially $s = 0.5$. Then, the first-period price is $P_1 = 1$ and is 50% lower than in the absence of a dynamic spillover effect (i.e., the case with $s = 0$). If the spillover effect increases to $s = 0.75$, then the first-period price falls from $P_1 = 1$ to $P_1 = 0.5$, a further 50% reduction. Notice that in this type of dynamic market, the (long-term) profit-maximizing first period price can be less than marginal cost. This is reminiscent of below-cost pricing that may arise when a firm sells complementary products (*e.g.*, a firm might sell razors at prices below cost in order to sell more blades later).

The same logic also applies to other demand-increasing investments, such as product *quality improvements and advertising. That is, such investments increase the firm's* current volume of sales and thus have a dynamic spillover effect on future sales. (In the case of a permanent quality improvement, future sales will be higher both because of the higher quality and also because of the dynamic spillover effect.) The firm therefore has a greater incentive to undertake such investments than it would have if it maximized short-term profit. A similar logic also applies to cost-reducing investments. When a firm decides how much to invest to reduce its variable costs, the firm takes into account that a cost reduction will allow it to charge a lower price and increase its current volume of sales. In addition, the firm takes into account that the higher current sales will generate higher future sales due to the dynamic spillover effect. Thus, the firm has a greater incentive to reduce variable costs than it would have if it maximized short-term profit.

To summarize, in markets with dynamic demand spillovers, firms have an incentive to engage in penetration pricing, the strategy of setting a relatively low current price to create higher future demand. This is a rational strategy because the resulting decrease in short-term profit is more than offset by an increase in future profits.

3. Implications For Merger Analysis

This section discusses three important implications of penetration pricing for merger analysis.

First, penetration pricing has an important implication for the implementation of the *ssnip* test and market definition. If one were erroneously to evaluate the profitability of a *ssnip* using the *static* Lerner Condition, then one likely would find the *ssnip* to be profitable. However, a correct implementation of the *ssnip* test should be based instead on the *dynamic* Lerner condition (see equation (A4)), which takes into account the dynamic spillover effect. This is what a forward-looking hypothetical monopolist who maximizes long-term profit would use.

Second, the preceding discussion also has implications for the use and interpretation of econometric studies for the purposes of market definition. For example, even if a rigorous econometric study were to find that the short-term demand for a group of products is relatively inelastic, that fact would not imply that the group of products is a proper relevant antitrust market.

Third, penetration pricing has implications for competitive effects analysis. Notice first that when there are two (or more) firms, low penetration pricing by one firm will also increase the future demand faced by the *other* firm(s). This is because a firm's current sales will have a spillover effect on the future sales of the product category as a whole. For example, seeing an increasing number of people using an iPod creates a bandwagon effect both for portable music devices in general, as well as for the iPod brand. A similar effect

applies to satellite radio brands. Increased sales of XM Radio will also promote satellite *radio in general, not just XM Radio, which will increase the future demand for Sirius as* well.

Consequently, each firm's low penetration price in period 1 creates a positive externality on the other firm's profit in period 2. This is because by reducing its price in period 1, a firm sells more in period 1, which means that the other firm also will obtain a greater boost to its second-period demand through the dynamic demand process. In some sense, penetration pricing has a "public good" (*i.e.*, "externality") aspect. Pre-merger, however, each firm does not account for the spillover benefit obtained by the other firm, and therefore there is "under-provision of the public good" in the sense that there is too little penetration pricing. This is a type of "free-rider" problem. A merger will allow the two firms to internalize the positive externality created by penetration pricing, giving them an incentive to further decrease their prices to boost future demand. This incentive to reduce prices post-merger may offset or even override the incentive to raise prices that merging firms have in standard unilateral effects analysis.[11]

The increased incentive to reduce prices post-merger can also be understood in the context of the two-period model described above. The internalization of the positive externality on the other firm's future profit can be thought of as corresponding to an increase in the extent of the dynamic spillover effect, s. As a result, in the same way that an increase in the extent of the dynamic spillover effect, s, leads a firm to decrease its first-period price, the merger will create an incentive for the merging firms to decrease their first-period prices post-merger. In addition, the merged firm will have an increased incentive to undertake both demand-enhancing investments (product quality improvements and advertising) and cost reducing investments. In a longer time frame, these effects will continue to occur as long as demand exhibits dynamic spillover effects.

[11] The positive externality discussed here thus coexists with the usual negative externality between a firm's lower price in period t and the other firm's profit in period t.

Appendix B

Dynamic Demand Functions and Implications for Merger Analysis:

The Effects of Lump Sum Payments for Inputs on Downstream Output Prices

The purpose of this Appendix is to establish two important results. First, in the presence of dynamic demand spillovers, *lump sum* payments to input suppliers have the effect of raising downstream output prices. Second, if the merger of two users of a given input weakens the input supplier's bargaining position vis-à-vis the merging firms, then there is a pro-competitive merger effect regardless of whether the weaker bargaining position of the supplier leads to lower variable (*i.e.*, per unit) payments or to lower lump sum payments from the merged firm.

When suppliers set input prices on a per unit basis and have a degree of market power, it is well understood that the merger of two customers may generate a procompetitive effect if it gives the merging parties some degree of countervailing bargaining leverage. That is, suppose that the merged firm is able to negotiate a lower price per unit (for an unlimited number of units) of an input sold by a supplier with market power. Under these conditions, simple microeconomic theory would imply that the input purchaser would have an incentive to pass a portion of these input cost savings on to consumers in the form of lower output prices. This Appendix will show that in markets with dynamic demand spillovers, a similar result applies when supply contracts specify lump sum payments (as opposed to per unit prices) for the inputs.

Markets with dynamic demand spillovers have the property that lump sum payments to input suppliers have an effect on output prices. This is because lump sum payments represent a fixed cost *ex-post* (*i.e.*, in the future, after the payments have been agreed upon), but a variable cost *ex-ante* (*i.e.*, from the perspective of the present, before the amounts of the payments are determined). Therefore, the expectation of making lower lump sum payments for inputs in the *future* increases a firm's incentive to engage in low penetration pricing in the *present*. This result stems from the observation that when a firm expects to pay a smaller fraction of its future profits to input suppliers, the firm perceives a greater return from increasing its current volume of sales as a means to boost future demand and increase future profits (through dynamic demand spillovers).[299]

Drawing on these results, this Appendix will explain that when a merger between two purchasers of a given input reduces the supplier's bargaining leverage vis-à-vis the merging firms, there is a pro-competitive merger effect, even if the payments for the input involve only lump sum payments. This arises from the fact that the merged firm will

[299] Therefore, the expectation of making lower lump sum payments for inputs in the future also increases a firm's incentive to undertake other demand-enhancing investments (such as quality improvements and advertising) as well as cost-reducing investments.

expect to keep a higher fraction of future profits and, as a result, will have a greater incentive to engage in low penetration pricing, even when the payments that will be made to suppliers are lump sum.

The rest of this Appendix is organized as follows. Section 1 provides a brief discussion of the efficiency rationale for lump sum payments in the context of bilateral bargaining and their effect on downstream output prices. Section 2 analyzes through an illustrative two-period model how a firm's pricing decisions depend on lump sum payments to input suppliers when there are dynamic spillover effects. Section 3 derives implications for merger analysis.

1. Bilateral Bargaining, Lump Sum Payments For Inputs, And Downstream Output Prices

Consider an upstream monopolist (input supplier) selling to a single downstream buyer. To fix ideas, suppose that the buyer in question is a satellite radio provider and the input supplier is a content provider with exclusive rights on one of the major sports. Both sides of this transaction are large and sophisticated economic agents. As a result, neither of them can be thought of as the dominant "price setter." Rather, the two parties can be thought of as jointly determining the price and quantity of the input through a process of bilateral bargaining and negotiation.[300]

Under standard "textbook" assumptions (*i.e.*, no uncertainty, no asymmetric information, etc.), the bilateral bargaining model leads to an efficient outcome. For example, the content provider and the satellite radio provider can agree to a pricing scheme that has two components: (a) a per-subscriber price for the input (*i.e.*, for the rights to offer the content to subscribers), and (b) a lump sum payment from the satellite radio provider to the content provider. An efficient outcome can be achieved by setting the per-subscriber price equal to the content provider's marginal cost of supplying broadcast rights.[301] This guarantees that the satellite radio provider faces the true resource cost of the input and therefore makes efficient output decisions (*e.g.*, the amount of coverage of that particular sport to be aired on the radio's sports channel). In other words, marginal cost pricing ensures that the buyer will produce the highest possible value from the input (or generate the biggest possible

[300] The economic literature sometimes refers to this bilateral bargaining process as bilateral monopoly, to be contrasted with the case of pure monopoly where the price is set by the seller (content provider), and the case of pure monopsony where the price is set by the buyer (satellite radio provider). This literature dates back to Arthur L. Bowley, *Bilateral Monopoly*, 38 ECON. J. 651 (1928). Some widespread misconceptions surrounding the bilateral monopoly problem are discussed in Roger D. Blair, David L. Kaserman & Richard E. Romano, *A Pedagogical Treatment of Bilateral Monopoly*, 55 S. ECON. J. 831 (1989).

[301] For broadcast media, royalty payments might be the main marginal cost.

total surplus).[302] The lump sum payment then is the mechanism with which the buyer *shares the gains from trade with the seller.*[303]

It should be emphasized that the bilateral bargaining model is different from the standard (pure) monopsony model in two respects. First, in the monopsony model, the supply side of the market is assumed to consist of a large number of small input suppliers who have no bargaining leverage (*i.e.*, they take the input price set by the monopsonist as given).[304] Second, the monopsonist is constrained to use linear pricing, *i.e.*, it must choose a constant per-unit price and cannot use lump sum payments. For these reasons, an increase in monopsony power leads to an inefficient reduction in the amount of input purchased (and thus a lower input price) which in turn leads to an inefficient output reduction (and thus a higher output price). In sharp contrast, in the standard bilateral bargaining analysis, an increase in the bargaining leverage of the buyer does not lead to any inefficient input or output reduction, or a higher output price. This is because a change in the parties' relative bargaining leverage leads to a change in the size of the lump sum payment, but it does not change the per-unit price of the input (as the latter remains equal to the supplier's marginal cost).

Similarly, the bilateral bargaining model is different from the standard (pure) monopoly model. In the monopoly model, the demand side of the market consists of a large number of small buyers with no bargaining leverage and who take the price set by the monopolist as given. The monopolist is constrained to choose a constant per-unit price and cannot use lump sum payments. These assumptions imply that an increase in monopoly power leads

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[302] Marginal cost pricing may not be optimal if the "textbook assumptions" of the standard bilateral monopoly model do not hold. In particular, when the level of demand for the final product is uncertain, efficient risk-sharing between the supplier and the distributor may lead to a price greater than marginal cost (and to a lower lump sum payment). For risk-averse firms, that is a more efficient arrangement as it allows them to share the risk associated with demand uncertainty. This is a type of "metering," though in this analysis it is not used to price discriminate or as part of a tying arrangement. Other instances where departures from marginal cost pricing may be efficient arise in the presence of information asymmetries. For example, similar contracts with price above marginal cost can mitigate moral hazard issues (*e.g.*, by increasing the supplier's incentive to undertake non-contractible, demand-enhancing investments after the contract is signed). They also can be used as a screening device (*e.g.*, when the supplier does not know how efficient the distributor is) and as a signaling device (*e.g.*, when the distributor cannot observe or verify the quality of the product). For a more complete discussion of these issues, *see* Jean Tirole, THE THEORY OF INDUSTRIAL ORGANIZATION (MIT Press 1990) at 176-78.

[303] We adopt an *efficient bargaining* framework to simplify the analysis. The main result of this Appendix – that lump sum payments to upstream input suppliers may have an effect on downstream output prices – continues to hold even if the bargaining is more complex.

[304] The acquisition of content by satellite radio providers involves direct bargaining with content owners. The content is not fungible, as in the standard monopsony model. Instead, it is highly differentiated. The owners of certain content have potential market power on the sell-side because their content is uniquely differentiated and highly desirable.

to an inefficient output reduction and a higher price for consumers.[305]

We now turn to the relationship between lump sum payments to input suppliers and downstream output prices. To fix ideas, consider the effect of lump sum payments to content providers on the pricing decisions of satellite radio providers for their final products. For a satellite radio provider, the lump sum amount that it has agreed to pay to a content provider (at the beginning of the current period) represents a fixed cost and thus has no effect on the pricing decision of the satellite radio provider in the current period.[306] However, the analysis is more complex when the satellite radio provider can affect future lump sum payments by its current pricing. In this scenario, the satellite radio provider should take this interdependence into account when setting the current price of its radio service. In effect, this is because future lump sum payments are fixed costs ex-post (*i.e.*, after they have been written into the supply contract), but they are variable costs ex-ante (*i.e.*, before they are agreed upon). The next section will show that this is precisely the situation faced by a firm whose product demand is characterized by dynamic demand spillovers. The last section will draw implications of this fact for merger analysis.

2. The Firm's Pricing Decision

The basic illustrative set up is similar to that of Appendix A: there is a firm (satellite radio provider) that sells its product in a market that lasts for two periods, and faces a dynamic demand for its product given by equations (A1) and (A2), for periods 1 and 2, respectively.

The following modification is now added. The satellite radio provider needs an input (programming content) which it can acquire from a unique input supplier (content provider). Both the satellite radio provider and the content provider are assumed to be large, sophisticated buyers and, as a result, their interaction can be best described as bilateral bargaining. Furthermore, it is assumed that at the beginning of each period, before the satellite radio provider has set its output price, the two parties bargain over the terms of trade and reach an efficient bargaining agreement to cover the supply of content for the upcoming period.

We draw on the discussion of the previous section and assume for simplicity that the content provider has zero marginal cost. (In addition, there is no demand uncertainty or asymmetric information.) Under these conditions, an efficient agreement generally will involve a lump sum payment from the satellite radio provider to the content provider. The variable F_t denotes the lump sum payment that the satellite radio provider pays to the content provider in period t. Thus, the satellite radio provider's discounted sum of profits

[305] Bilateral bargaining therefore does not lead to a "double distortion" of output but rather an increase in output up to the efficient, competitive level.

[306] Alternatively, the lump sum payment could represent a sunk cost, depending on when the lump sum amount is paid out.

from periods 1 and 2 (*i.e.*, its long-term profit) is:

$$\Pi_1 + \delta\,\Pi_2 = (P_1 - C_1)d_1(P_1) - F_1 + \delta\,[(P_2 - C_2)d_2(P_2, Q_1) - F_2] \qquad \text{(B1)}$$

With respect to the determination of the lump sum amount F_2, we assume that the satellite radio provider and the content provider will agree at the beginning of period 2 on a lump sum payment that corresponds to a fraction (x) of the second-period gross profit of the satellite radio provider. This is consistent with standard bargaining theory.[307]

Under the above assumptions, and given the lump sum amount F_1 agreed upon by the parties at the beginning of period 1, the satellite radio provider will choose output prices in periods 1 and 2 by solving:

$$\max_{P_1, P_2}\ (P_1 - C_1)d_1(P_1) - F_1 + \delta\ (1-x)(P_1 - C_2)d_2(P_2, Q_1) \qquad \text{(B2)}$$

Letting $s = \partial d_2(P_2, Q_1)/\partial Q_1$ denote the dynamic spillover effect between current and future sales, the first-order conditions for profit maximization yield:

$$\frac{P_1 - [C_1 - \delta(1-x)s(P_2 - C_2)]}{P_1} = \frac{1}{E_1} \qquad \text{(B3)}$$

$$\frac{P_2 - C_2}{P_2} = \frac{1}{E_2} \qquad \text{(B4)}$$

[307] Under standard bargaining theory, the outcome is an equal split of the total profits (surplus) generated by the transaction, relative to the parties' next-best alternatives. For example, suppose that (a) the content provider has no alternatives and thus has a reservation price of zero, and (b) in the absence of an agreement, the gross profit of the satellite radio provider would be reduced by 20%. In this case, an equal split of the surplus corresponds to x = 10% (*i.e.*, the lump sum payment to the content provider corresponds to 10% of the gross profit of the satellite radio provider). This outcome is referred to as the Nash bargaining solution, due to John F. Nash, Jr., *The Bargaining Problem*, 18 ECONOMETRICA 155 (1950), who provided an axiomatic foundation. This work is further extended in John Nash, *Two-Person Cooperative Games*, 21 ECONOMETRICA 128 (1953). Ken Binmore, Ariel Rubinstein & Asher Wolinsky, *The Nash Bargaining Solution in Economic Modelling*, 17 RAND J. OF ECON. 176 (1986) provided conditions under which the Nash bargaining solution coincides with the perfect equilibrium of the non-cooperative, alternating-offer bargaining game analyzed by Ariel Rubinstein, *Perfect Equilibrium in a Bargaining Model*, 50 ECONOMETRICA 97 (1982).

Equations (B3) and (B4) are the dynamic and static Lerner conditions, as in equations *(A4), (A5) and (A6) in Appendix A.*

Equation (B3) shows that the first-period price (P_1) does not depend on the magnitude of the lump sum amount that the satellite radio provider has agreed to pay in period 1 (F_1). Likewise, equation (B4) shows that the second-period price (P_2) does not depend on the second-period lump sum payment, since equation (B4) does not involve the fraction x. These observations confirm a general result in the context of this two-period model: the fixed costs that a firm incurs in a given period do not affect the price that the firm charges for its product in that period.

However, the lump sum amount that the satellite radio provider *expects to pay in period 2* does affect the price that the satellite radio provider charges in period 1, since equation (B3) involves the fraction x. This occurs because the second-period lump sum payment represents a fixed cost *ex-post* (*i.e.*, from the perspective of period 2), but is a variable cost *ex-ante* (*i.e.*, from the perspective of period 1). That is, the satellite radio provider can alter the amount it will pay to the content provider in period 2 by modifying its price in period 1.

Moreover, if in period 1 the satellite radio provider expects that it will pay a smaller amount in period 2 (*i.e.*, if the lump sum payment to the content provider will represent a smaller fraction x of the second-period profit of the satellite radio provider), then equation (B3) shows that the satellite radio provider behaves as if its first-period marginal cost is lower. As a result, in the same way that a marginal cost reduction is passed through to consumers in the form of a lower price, a reduction in the bargaining leverage of the content provider (*i.e.*, a reduction in the magnitude of the fraction x) leads to a lower first-period price.

This section's main result can be stated as follows:

> When there are dynamic spillover effects (*i.e.*, s > 0), if future lump sum payments to input suppliers will represent a smaller share of the firm's future profits, then the firm has an incentive to reduce its current price (*i.e.*, P_1 decreases as x decreases). In other words, if the firm expects to pay lower lump sum amounts in the future, then it charges a lower price in the present.

The intuition is as follows. When $s > 0$, the demand for the product will be higher in period 2 if there are more sales in period 1. This creates an incentive to set a low penetration price in period 1 (relative to the price that would maximize short-term profit) in order to boost demand and profitability in period 2. The higher the "weight" $\delta(1-x)$ that the firm assigns to the second-period profit, the lower the first-period price. In particular, if the firm expects to keep a higher fraction of the gross profit in period 2 (*i.e.*, if 1-x is

larger), then the firm will weigh the future relatively more, and thus has a greater incentive to decrease price in period 1.

To summarize, when demand exhibits dynamic spillover effects, a firm has a *greater* incentive to engage in penetration pricing (*i.e.*, set a lower current price) if it expects to surrender a *smaller* fraction of its future profits in the form of lower lump sum payments to input suppliers. A similar analysis also would apply to the firm's incentive to undertake other demand-enhancing investments (*e.g.*, product quality improvements and advertising) as well as cost-reducing investments.

3. Implications For Merger Analysis

Mergers often allow the merging parties to negotiate better terms with their suppliers. It is well understood that when these "better terms" take the form of lower *per-unit* input prices, they will be passed through in part to final consumers in the form of lower output prices.

The above analysis has demonstrated that lower *lump sum* payments similarly lead to lower prices for final consumers, if there are dynamic demand spillovers. A direct consequence of this result is that mergers in such dynamic markets produce a pro-competitive effect if the input supplier's bargaining leverage vis-à-vis the merging parties decreases post-merger. This favorable outcome occurs because the merged entity expects that it will concede a smaller fraction (relative to pre-merger) of its future profits to input suppliers, and hence the merged entity has a greater incentive to engage in penetration pricing (*i.e.*, charge lower current prices to boost future sales). In addition, the merged entity also has an increased incentive to invest in the product, relative to the incentives that the merging firms have pre-merger.

INTERNATIONAL

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Ph.D. Economics
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FIELDS OF SPECIALIZATION

- Industrial Organization
- Competition and Antitrust Policy
- Economics of Information
- Law and Economics

EMPLOYMENT EXPERIENCE

Professor of Economics and Law, Georgetown University Law Center, 1982–present.

Guest Scholar, Brookings Institution, 1990–1991.

Visiting Professor, Massachusetts Institute of Technology, Spring 1986.

Visiting Interdisciplinary Professor, Georgetown University Law Center, July 1981–June 1982.

Associate Director for Special Projects, Bureau of Economics, Federal Trade Commission, January 1980–June 1981.

Assistant Director for Industry Analysis, Bureau of Economics, Federal Trade Commission, September 1979–January 1980.

Deputy Assistant Director for Consumer Protection, Bureau of Economics, Federal Trade Commission, December 1978–September 1979.

Economist, Division of Consumer Protection, Bureau of Economics, Federal Trade Commission, July 1978–December 1978.

Economist, Office of Economic Analysis, Civil Aeronautics Board, September 1977–July 1978.

Economist, Federal Reserve Board, July 1972–September 1977.

Adjunct Professor, Department of Economics, University of Pennsylvania, September 1977–June 1978.

Adjunct Professor, Department of Economics, George Washington University, September 1975–January 1978.

SELECTED PROFESSIONAL ACTIVITIES

Associate Editor, Economists' Voice

Associate Editor, Litigation Economics Review

Consultant, FTC Joint Venture Project (1999).

Advisory Committee, FTC Hearings on Global and Innovation-Based Competition (1996).

Associate Editor (Industrial Organization), *Journal of Economic Perspectives* (1987–1993).

American Bar Association Antitrust Task Force on Second Requests (1990).

Advisory Board, Georgetown Project on Treble Damages (1986–1987).

Associate Editor, *Journal of Industrial Economics* (1983–1988).

Associate Editor, *International Journal of Industrial Organization* (1984–1989).

Secretary, Antitrust Section, American Association of Law Schools (1983–1984).

Memberships: American Economic Association, American Bar Association, Phi Beta Kappa.

Nominating Committee: American Economic Association, 1982.

Economics Editorial Advisor, *Journal of Consumer Research*, 1982.

OTHER ACTIVITIES

Board of Directors, CRA International

Management Advisory Committee, La Leche League International (1994–1999).

Board of Trustees, The Lowell School (1989–1995).

HONORS AND AWARDS

NSF Graduate Fellowship, 1968–1972.

Graduated *summa cum laude*, with Honors in Economics, from the University of Pennsylvania, 1968.

Schoenbaum Prize in Economics, University of Pennsylvania, 1968.

Phi Beta Kappa, 1968.

PUBLICATIONS

Books and Reports

Strategy, Predation, and Antitrust Analysis. (Editor.) Federal Trade Commission, 1981.

Consumer Post-Purchase Remedies. With J. Howard Beales et al. Federal Trade Commission Staff Report, 1980.

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Articles

"Exclusionary Vertical Restraints: Did the Chicago-School Overshoot the Target?" (Prepared for Kirkpatrick Conference at GULC, April 2007) (forthcoming)

" The Controversy over the Proper Antitrust Standard for Anticompetitive Exclusionary Conduct," Barry Hawk (ed), *Fordham Competition Law Institute 33rd Annual Conference on International Antitrust Law and Policy* 2006

Exclusionary Conduct, Effect on Consumers, and the Flawed Profit-Sacrifice Standard," Antitrust Law Journal (2006).

"Anticompetitive Overbuying by Power Buyers," Antitrust Law Journal (2005)

"A Few Righteous Men: Imperfect Information, Quit-for-Tat and Critical Mass in the Dynamics of Cooperation." Festschrift in Honor of Joseph E. Stiglitz (2003). With Serge Moresi.

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"Analyzing Vertical and Horizontal Cross Ownership in Cable Television: The Time Warner-Turner Merger." With S. Besen, J. Murdoch, D. O'Brien, and J. Woodbury. In J. Kwoka and L. White (eds.), *The Antitrust Revolution*, 1998.

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"Rowing Against the Tidewater: A Theory of Voting by Multi-Judge Panels." With D. Post. Georgetown *University Law Review*, 1992.

"Evaluating Network Pricing Self-Regulation." In Guerin-Calvert and Wildman (eds.), *Electronic Services Networks: A Business and Public Policy Challenge of Electronic Shared Networks*, 1991.

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"Monopoly Power and Market Power in Antitrust Law." With T. Krattenmaker and R. Lande. *Georgetown University Law Review*, 1987.

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"Information, Welfare and Product Diversity." With J. Stiglitz. In Feiwel et al. (eds.), *Arrow and the Foundations of the Theory of Economic Policy*, 1987.

"Antitrust Analysis of Exclusionary Rights: Raising Rivals' Costs to Gain Power Over Price." With T. Krattenmaker. *Yale Law Journal*, December 1986.

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"Economics of Private Antitrust Litigation." With L. White. *Antitrust Law Journal*, 1986. Reprinted by the Senate Judiciary Committee.

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"Firm-Specific Information, Product Differentiation and Industry Equilibrium." With J. Perloff. In Morris et al. (eds.), *Strategic Behavior and Industrial Competition*, 1986.

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"Self-Selection and Turnover in the Labor Market." With J. Salop. *Quarterly Journal of Economics*, November 1976.

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Reviews/Comments/Testimony

"Slap Their Wrists? Tie Their Hands? Slice Them Into Pieces? Alternative Remedies for Monopolization in the *Microsoft* Case." *Antitrust*, 1999.

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"*Kodak* as Post-Chicago Law and Economics." *CRA Perspectives*, April 1993. Reprinted in Texas Bar Association, *Antitrust and Business Litigation Bulletin*, November 1993.

"Antitrust Goes to College." With Lawrence White. *Journal of Economic Perspectives*, Summer 1991.

"Analysis of Entry in the New Merger Guidelines." *Brookings Papers on Economic Activity*, 1991.

"Mergers and Antitrust." *Journal of Economic Perspectives*, 1987.

"Comment on Golbe and White, 'Time Series Analysis of Mergers.'" In Auerbach et al., *Mergers and Acquisitions*, National Bureau of Economic Research.

"Policy Implications of Conference Papers." In Auerbach et al., *Mergers and Acquisitions*, National Bureau of Economic Research.

"Evaluating Uncertain Evidence with Sir Thomas Bayes." *Journal of Economic Perspectives*, Summer 1987.

"Implications of the Georgetown Project for Treble Damages Reform." Senate Judiciary Committee, March 21, 1986.

"Policing Deceptive Advertising." Serial No. 97-134, 97th Congress.

"Entry Barriers, Consumer Welfare, and Antitrust Reform." In B. Bock et al., *Antitrust and New Views of Microeconomics*. Conference Board, 1986.

"Buy American, Save Your Job?" In J. Tobin et al., *Macroeconomics, Prices, and Quantities*. Brookings Institution, 1983.

"Selling Consumer Information." With H. Beales. In J. Olson et al., *Advances in Consumer Research*, Vol. VII, 1980.

"Comment on R. Schmalensee, 'On the Use of Economic Models in Antitrust.'" In O. Williamson et al., *Antitrust Law and Economics*, 1980.

"Review of K. Lancaster, 'Variety, Equity, and Efficiency,'" *Journal of Economic Literature*, 1980.

SELECTED CONSULTING EXPERIENCE

Telecommunications Transactions

Sprint/Nextel

NewsCorporation/DIRECTV

Time Warner/AOL

CBS/Viacom

PRIMESTAR

SBC/Ameritech

Time Warner/Turner Broadcasting

CBS/Infinity Broadcasting

EXHIBIT A

REDACTED
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INTERNATIONAL

STEVEN R. BRENNER

Vice President

Ph.D. Economics,
Stanford University

B.A. Economics,
Wabash College

Dr. Brenner is an expert in antitrust economics and in the economics of the telecommunications, broadcasting, cable, and recording industries. Since joining CRA in 1988, he has worked on antitrust and merger analyses in a variety of industries; policy issues in the telecommunications, broadcasting, and cable industries; and intellectual property rights issues in the recording industry.

PREVIOUS EXPERIENCE

OECD, Division on Competition and Consumer Policy

Consultant, August 1990–September 1992. Dr. Brenner served as a Consultant to the OECD in Paris while on leave from Charles River Associates. He was principal author of a report on competition policy issues in the broadcast industry drafted for the OECD Committee on Competition Law and Policy, and co-author of a report of the OECD Secretariat analyzing the treatment by competition policy in OECD countries of vertical restrictions in franchise agreements.

Cornell, Pelcovits, & Brenner Economists Inc.

Vice President, February 1982–September 1988. As a microeconomic consultant primarily in the fields of telecommunications, broadcasting, intellectual property rights, and antitrust economics, Dr. Brenner performed the following work:

- Developed and presented expert testimony before state public utility commissions on a variety of telecommunications policy and empirical issues.
- Prepared antitrust damage studies and analyzed antitrust liability issues.
- Analyzed intellectual property rights implications of home audio and video taping.
- Designed and developed tariffs for cellular telephone and mobile satellite service applications before the FCC.

Owen, Cornell, Greenhalgh, & Myslinski Economists, Inc.

Senior Economist, September 1981–February 1982. As a microeconomic consultant in telecommunications, broadcasting, and antitrust economics, Dr. Brenner worked on various projects, including one analyzing the economic impact of broadcasting regulations on the video industry and on its use of new technologies.

Office of Plans and Policy, Federal Communications Commission:

Senior Economist, July 1979–September 1981. As the economist on the UHF Comparability Task Force, Dr. Brenner analyzed the economics of UHF broadcasting, wrote parts of Task Force reports and separate reports, designed two large surveys, and carried out econometric analysis of data. Other responsibilities included evaluating broadcast and technical standards policy proposals, analyzing radio frequency interference policy, and making oral presentations to the Commission at formal agenda meetings on UHF comparability and on technical standards for stereophonic AM radio.

Grinnell College

Assistant Professor of Economics, August 1973–July 1979. Dr. Brenner taught courses in industrial organization, statistics, microeconomic analysis, the economics of regulation, international economics, and US economic history.

University of Iowa

Visiting Instructor of Economics, January 1977–May 1977. Taught graduate and undergraduate courses in US economic history.

Stanford University

Lecturer in Economics, January 1972–May 1972. Taught a course in microeconomic theory.

California State College at Hayward

Instructor in Economics, September 1968–December 1971. Taught courses in principles of economics.

PROFESSIONAL AFFILIATIONS

Assistant Editor, *Antitrust Law Journal,* 2001–Present.